

CLASSIFICATION **CONFIDENTIAL**CENTRAL INTELLIGENCE AGENCY
INFORMATION FROM
FOREIGN DOCUMENTS OR RADIO BROADCASTS
CONFIDENTIAL

REPORT

CD NO.

50X1-HUM

COUNTRY: **USSR**DATE OF
INFORMATION **1947**SUBJECT: **Scientific - Power engineering**HOW
PUBLISHED: **Monthly periodical**DATE DIST. **14 March 1949**WHERE
PUBLISHED: **Moscow**NO. OF PAGES **7**DATE
PUBLISHED: **August 1947**LANGUAGE: **Russian**SUPPLEMENT TO
REPORT NO.

THIS DOCUMENT CONTAINS INFORMATION AFFECTING THE NATIONAL DEFENSE
OF THE UNITED STATES WITHIN THE MEANING OF ESPIONAGE ACT 50
U. S. C. 31 AND 32, AS AMENDED. ITS TRANSMISSION OR THE REVELATION
OF ITS CONTENTS IN ANY MANNER TO AN UNAUTHORIZED PERSON IS PRO-
HIBITED BY LAW. REPRODUCTION OF THIS FORM IS PROHIBITED.

THIS IS UNEVALUATED INFORMATION

SOURCE: Vestnik Akademii Nauk SSSR, No 8, 1947. (FDB Per Abs 57T8 --
Translation requested.)

FIRST COUNCIL FOR COORDINATING THE SCIENTIFIC RESEARCH
OF POWER-ENGINEERING INSTITUTES

G. M. Krzhizhanovskiy

The First Five-Year Plan called for extensive scientific work in power engineering and general coordination of this work.

The Power-Engineering Institute of the AN SSSR (Academy of Sciences USSR) and various power-engineering institutes of Republic Academies of Sciences, and Affiliates of the AN SSSR are working on important power-engineering problems which have a direct bearing on the successful fulfillment of the new Five-Year Plan and on the future progress of Soviet power engineering.

Such problems include study of steam in all its phases, high-voltage DC transmission, electrical machinery construction, fuel chemistry, artificial underground formation of gas from coal, gas turbines, industrial power engineering, collective farms, transportation, power-engineering systems, etc.

Coordinating these problems, eliminating duplication, cooperation and exchange of data, personal contacts, self-criticism, expedient use of resources, rational organization and exploitation of laboratory facilities, etc.--all these are important for the successful fulfillment of the Five-Year Plan of the AN SSSR.

The First Council of Power-Engineering Institutes met in the Institute, 19-24 May 1947, to discuss the problem of coordinating scientific work.

The author of this article made the introductory report, "Scientific Problems of Power Engineering," to the plenum of the council. The representatives of the Republic Academies of Sciences gave brief reports on five-year plans for scientific research related to power-engineering development in the Republic. Subsequent work of the council was assigned to four sections: power engineering, electrotechnical, thermotechnical, and power chemistry.

- 1 -

CLASSIFICATION **CONFIDENTIAL**

STATE	<input checked="" type="checkbox"/> NAVY	<input checked="" type="checkbox"/> NSRB	DISTRIBUTION					
ARMY	<input checked="" type="checkbox"/> AIR	<input checked="" type="checkbox"/> FBI						

50X1-HUM

CONFIDENTIAL

The power-engineering section devoted its first meeting to power engineering in industry. The following reports were given: V. I. Veyts, "Power-Engineering Efficiency and Its Improvement in Industry," N. A. Semenenko, Doctor of Technical Sciences, "Uniting Power Engineering and Technology to Utilize High-Temperature Secondary Power Resources in Industry," I. N. Butakov, Doctor of Technical Sciences, and G. I. Rossiyskiy, Candidate in Technical Science, "Electric Power Plans for Utilizing Low-Potential Heat of Secondary Power Resources in Industry."

The section noted the present state of theoretical and practical work, and the connections between power engineering and industrial technology as well as between industrial and regional power engineering. The timely decision of the Bureau of the Division of Technical Sciences, AN SSSR, to hold a special session in October 1947 devoted to industrial power-engineering problems was mentioned.

The second and third meetings were devoted to rural and urban power engineering. Reports were made by Candidates in Agricultural Sciences A. G. Zakharin on "Local Power Systems in Agricultural Districts," and P. N. Listov, "New Electrification Plan for Agriculture."

The section noted coordination of operations in agricultural power engineering and recommended the establishment of personal liaison between scientific groups to discuss basic problems and work programs. The publication of a monograph on the fundamentals of power engineering in agriculture should be of great importance.

The section considered developing agricultural power engineering along the following lines: (1) investigation of agricultural power engineering in each republic on the basis of power classifications of agricultural districts and study of the power surplus in the various agricultural zones; and (2) utilization of power resources and electrification of agriculture based on a model district characteristic of the republic.

The following two reports concerned urban power engineering: "Plan for Power Supply and Heating," by L. A. Melent'ev, Doctor of Technical Sciences, and "Gas Supply for TETs and for Moscow Industry to be Obtained From the Moscow Coal and Peat Fields," by Z. F. Chukhanov, Corresponding Member, AN SSSR. The section also acknowledged the need of power-engineering development in small cities and recommended that pertinent problems be included in the study courses of power-engineering institutes of Republic Academies of Sciences and Affiliates of the AN SSSR.

At a joint meeting of the power-engineering and electrotechnical sections the following reports on power systems were given: V. V. Bolotov, Doctor of Technical Sciences, "The Rational Structure and Operation of Complex Power Systems," I. M. Markovich, Doctor of Technical Sciences, "The Regulation of Frequency and Power in Electric Systems," S. A. Lebedev, Active Member, AN SSSR, "Automatic Regulation of Synchronous Machines," M. M. Lebedev, Candidate in Technical Sciences, "The Power System of Sevan," and M. A. Mostkov, Doctor of Technical Science, "Hydroelectric Engineering in Georgia."

The section also recommended special periodic meetings between the various power-engineering representatives to discuss power engineering in the national economy and power systems.

The following report was heard and discussed in the electrotechnical section: "High Voltage DC Transmission," by K. A. Krug, Corresponding Member, AN SSSR, and A. R. Neyman, Doctor of Technical Sciences.

The problem of long-distance power transmission by high-voltage DC is the most important one in modern Soviet power engineering. During the past year, considerable work on this problem, partly experimental with actual models and partly theoretical has been done within the AN SSSR.

- 2 -

CONFIDENTIAL

50X1-HUM

CONFIDENTIAL

In the newly built direct-current laboratory of the Power-Engineering Institute, AN SSSR, a DC power transmission model was set up, and the data obtained greatly increased the reliability of direct-current transmission. The laboratory for high-voltage gas discharge did valuable research on DC corona. In Leningrad, M. P. Kostenko, Corresponding Member, AN SSSR, and his group did research on the theory of current transformation. The West Siberian Affiliate, AN SSSR, has started work on DC power transmission.

The section found that direct-current research must be intensified in the AN SSSR.

The section noted that the solution of problems in DC power transmission required extensive scientific research and large-scale industrial and experimental programs such as construction of an experimental DC transmission line, heavy-duty high-voltage switches, and special equipment. The section voted to have another meeting in September 1947. All interested organizations were requested to attend to coordinate direct-current research both in the AN SSSR and in other organizations. In addition, a permanent working commission for this problem was set up in the AN SSSR.

Contemporary methods of automatic control of frequency and power require maintaining approximately constant frequency and power, and must also meet the demands of maximum economy in the operation and unification of the power system. The RAN (special automatic distributor of active loads) suggested by the Power-Engineering Institute, AN SSSR, is used as an important supplement to the automatic frequency and power regulators and guarantees maximum economy in the operation of the entire system; it also enables control of frequency at the generating plants. The laboratory model of RAN, made in the electric laboratory of the Power-Engineering Institute, demonstrated the simplicity of this equipment.

The RAN works as follows: It automatically indicates at the dispatching point the correct distribution of loads among the plants. It automatically transmits instructions on the correct distribution of loads to the shift personnel at the electric plants. It automatically changes the load of electric plants. The last stage requires making power plants automatic, especially the automatic adjustment of boilers.

Experience with automatic frequency regulators and AC power in the power networks of the US and Western Europe have shown the practicability of maintaining the constancy of AC power with astatic control of frequency. Under conditions in the USSR, however, AC power constancy is not expedient, and the alternating current must vary with the active load distribution, up to the limiting values of the current as determined by the conductivity of intersystem connections.

The application of special automatic equipment in the Power-Engineering Institute's Plan permits an economic distribution of loads among the various plants of the power network and an economic regulation of AC power, making use of the advantages of the Dar'ye Fallu (transliteration) criterion at one stage of control. In working out the construction of the RAN for a power network, one must disregard the losses within the network.

The further work and the plans for power network must be carried out by the Power-Engineering Institute in close cooperation with the Ministry of Power Plants and with the power network. This will enable us to eliminate possible errors in suggested plans and constructions and to approach the solution of the most important problem--introduction of automatic control of frequency and power in Soviet power networks on a high technical level.

- 3 -

CONFIDENTIAL

50X1-HUM

CONFIDENTIAL

The automatic control of voltage not only serves to maintain the voltage at a certain level, but it also tends to increase the reliability of the network, i.e., the stability of parallel operation.

The use of proportional automatic voltage regulators, operating over the entire control range, makes it possible to compensate for stator reaction of synchronous machines and guarantees operation in the zone of "artificial stability"; i.e., when the angular deviations of the rotor axis of synchronous machines are greater than 90 degrees. Such a control is guaranteed by electronic voltage regulators of the VEI network.

The system of compounding synchronous generators, which has been elaborated upon during the past few years by the Power-Engineering Institute, AN ESSR, permits sensitive control and completely satisfies conditions for artificial stability.

A disadvantage of the system of simply compounding the load current is the unreliability of voltage constancy in the region near static instability and the low value of forced excitation during short-circuit loading. This error may be eliminated by the use of simplified regulator-correctors, which have been developed by the faculty of relay protection and automatic instruments of the MEI (Moscow Power Engineering Institute), and by the Electrotechnical Institute of the USSR. Such regulators guarantee constant voltage over the entire generator range from no load up to a maximum load. They create a sufficient force under short-circuit loading and do not lower the reliability of the excitation system.

With large-scale use of automatic voltage regulators, faulty operation of one regulator should not greatly affect operation of the whole network. Therefore, in analyzing the static stability of the network, the action of voltage regulators must be taken into account, i.e., one must determine the internal, and not the stated power capacity. By widespread use of the more perfect systems of automatic voltage regulators (electronic regulators, compound synchronous generators with a simplified excitation regulator, and amplidyne), the problem of static stability can be taken off the agenda.

Under these conditions, the far greater danger of disturbing the stability of parallel operation lies in the sudden disturbance of the network in connection with the vibrations of the synchronous generators, and not in the gradual increase of the load.

To solve the problem of guaranteeing static stability in power network, and thereby considerably increasing the reliability of electric supply, it is necessary to introduce the new systems of automatic voltage control as soon as possible. This will not offer any insurmountable difficulties because they are very simple to produce.

The section recommended continued work on automatic control of excitation in synchronous machines, especially the use of electromechanical devices for this purpose.

On the subject of high-voltage engineering, the section heard a report by I. S. Stekol'nikov, Doctor of Technical Sciences, on "High-Power Impulse Discharge and Lightning."

Most important among the high-voltage developments provided for in the Five-Year Plan are rational planning and reliable work on electric transmission lines. The solution to these problems is, to a considerable extent, connected with the development of effective and rational methods of protection against lightning. These methods must be based on research on all the factors governing lightning.

- 4 -

CONFIDENTIAL

CONFIDENTIAL

50X1-HUM

In prewar years, the Power-Engineering Institute, AN SSSR, in collaboration with the Ministry of Power Plants, as well as the Republic Academies of Sciences, Gidrometsluzhba (Hydrometeorological Service), and a number of scientific research institutes carried out extensive research on lightning and its controlling factors in 26 power systems. The research results were widely used in planning electric-transmission lines and industrial installations.

The above-mentioned work has permitted the classification of lightning factors by districts, and the revelation of certain basic elements common to all factors. The study of lightning and antilightning protection are currently being examined by the Power-Engineering Institute of the Azerbaydzhan SSR and the Hydroelectric Institute of the Armenian SSR, in connection with the establishment of mountain power network in Azerbaydzhan and Armenia.

The section noted the national economic and scientific importance of lightning research and recommended the continued study of factors governing a direct lightning stroke in order to classify the lightning characteristics for the various districts of the Union. It invited all Republic Academies and AN SSSR Affiliates to study the physics of lightning discharge and the geographical and orographic influences on it.

The section urged the mapping of thunderstorm regions in West Siberia, the Far East, Kazakhstan and Uzbekistan, where the next Five-Year-Plan will call for large-scale construction of electric-power lines. This work had to be included in the plans of the Republic Academies and AN SSSR Affiliates.

The section favored organizing a group in the Power-Engineering Institute for the purpose of studying the physics of lightning, and also forming a group in the Ministry of Power Plants to study the influence of lightning on power lines and instruments.

M. P. Kontenko, Corresponding Member, AN SSSR, reported on "Electric Machine Construction."

The section approved the plan of the Laboratory of Electrical Machines in the Power-Engineering Institute to develop new ideas, both practical and scientific, on electric machines with special features (a constant-frequency machine with alternating rotation speed, a machine with constant rotation speed and alternating frequency, a machine with rolling rotor, etc.).

The section realized the importance of laboratory participation in studying the problems of DC power transmission and admitted that electromagnetic phenomena in electric machines and DC instruments must first be studied.

For successful laboratory work one must strengthen the experimental base, increase the personnel, and solicit the participation of corresponding laboratories of power-engineering institutes of the Republic Academies in working out theoretical questions on electrical machines. In particular, many questions (those of autonomous power networks, construction and application of special electrical machines, such as electric motors for wind-power engineering and various agricultural plants, etc.) can and should be studied in the laboratories of the Power Engineering Institute and laboratories of the Republic Academies. The cooperation on these questions within the AN SSSR with a corresponding coordination of work with the electrical machine-building organizations, will be essential to the USSR national economy.

It is particularly important to increase the factory production potential to guarantee the rapid construction of models and experimental objects.

On the problem of electric modeling (miniature-scale operation with models), the section heard a report of I. I. Gutsanekher, Doctor of Technical Sciences, "Operation With Electric Models in Power Engineering."

- 5 -

CONFIDENTIAL

CONFIDENTIAL

50X1-HUM

The theory and practice developed by the Power-Engineering Institute, AN SSSR, in artificial electric modeling of physical phenomena has improved research methods and calculations in solving many problems of power-engineering. The instruments and instruments produced make it possible to recommend this method for solving the following most important problems: analysis of the stability of dynamic systems with many degrees of freedom and control systems; and calculation of electromagnetic and thermal fields in machines, instruments, and other equipment.

The section recommended that the power-engineering institutes of the Academies of Sciences of the Republics and AN SSSR Affiliates use the standard constructions of universal models (electric integrators), which have been developed by the electric modeling laboratory for research and calculation purposes.

For the successful development of methods and enlargement of the range of applications in power engineering, the efforts of the Power-Engineering Institute AN SSSR, must be united with the power-engineering institutes of the Republics and with the Affiliates of the AN SSSR by coordination of the various work plans and programs.

In the section on thermotechnics, the following reports were heard and discussed: "New Trends in Thermal Modeling," by Academician M. V. Kirpichev, "The Problem of High-Pressure Steam," by M. A. Styrikovich, Corresponding Member, AN SSSR, "Hydrodynamics of Two-Phase Currents in Pipes," by S. I. Kosterin, Doctor of Technical Sciences, and "Combustion of Estonian Shale in the Fireboxes of Steam Boilers," by Kh. E. Truu, Candidate of Technical Sciences. The section found it necessary to continue this work not only in the Power-Engineering Institute, AN SSSR, but also in power-engineering institutes of the Republic Academies of Sciences and AN SSSR Affiliates, coordinating this work in the Commission for High-Pressure Steam of the Power-Engineering Institute, AN SSSR. The section approved the practical results of the work done by the power-engineering department of the Institute of Industrial Problems, AN Estonian SSR, in utilizing methods of layer combustion of shale in boiler fireboxes, and the research work planned by the Institute in the field of compartment combustion of shale in fireboxes of high-pressure steam boilers.

Plans for research in thermotechnics, presented by representatives of Academies of Sciences of Estonia, Azerbaijan, Georgia, Kazakhstan, Ukraine, Belorussia, and the West Siberian branch of AN SSSR were also discussed.

The section expressed the desire that the Power-Engineering Institute, Azerbaijan AN, and the Thermotechnical Institute, AN SSSR, study methods of burning natural gases, taking into consideration the importance of these questions in the national economy of the above named Republics.

In the interests of closer coordination in thermotechnics, it was decided to hold annual conferences of representatives of the institutes of Republic Academies of Sciences and AN SSSR Affiliates; and to seek further coordination by exchanging data, by organizing expeditions, by scientific reports, by exchange of results on completed works, and by printed publications.

The power-chemistry section heard and discussed the following reports as follows: "Complex Power-Chemical Utilization of Fuel," by A. B. Chernyshev, Corresponding Member, AN SSSR, "Flameless Surface Combustion," by M. B. Ravich, Doctor of Technical Sciences, "High-Temperature Processing of Fuel," by A. A. Agroskin, Doctor of Technical Sciences, "The Work of the Department of Gas Turbines of the Power Engineering Institute, AN SSSR," by D. Ya. Aleksovich, Senior Scientific Collaborator, and "Problems on the Stability of Parts of Gas Turbines," by A. P. Filippov, Corresponding Member, AN SSSR.

- 6 -

CONFIDENTIAL

50X1-HUM

CONFIDENTIAL

The complex power-chemical utilization of solid fuel has great importance in the national economy as it provides the means of obtaining, besides heat energy, a large quantity of valuable raw material from local types of solid fuel, synthetic liquid fuel, lubricating oils, plastic substances, and other chemical products.

Of the three elementary methods of heat-processing solid fuel, coking, semicoking, and gasification, the two latter methods permit more extensive exploitation of various types of solid fuel. Increasing the amount of raw material for high-temperature fuel processing (coking) is very important.

In connection with increasing the gas supply for cities and industrial enterprises, great importance is attached to questions of rational gas combustion, especially the method of flameless combustion.

The studies conducted in the Power-Engineering Institute, AN SSSR, such as semicoking of fine-grained fuel, gasification of fuel under high pressure, new methods for high-temperature processing of fuel, and methods for flameless surface combustion of fuel -- all have great scientific and practical value. They have revealed great opportunities for the practical application of power-chemical exploitation of various types of solid fuel, especially cut peat, small coal fractions and lignite, etc. The experiments begun by the Power-Engineering Institute, AN SSSR, on underground distillation of oil shale and on gas turbine problems are likewise of great interest.

To obtain a more complete and rapid solution of the problem of the power-chemical exploitation of various solid fuels, and to secure large raw-material resources for the manufacture of chemicals and synthetic liquid fuels, we must develop scientific research. Such work should be done not only in the Power-Engineering Institute, AN SSSR, but also in the Republics' power-engineering institutes in cooperation with the former.

The participants of the conference noted the cooperation of the AN Estonian SSR with the Power-Engineering Institute, AN SSSR, on the problem of underground distillation of oil shale.

The section gave special attention to the question of organizing in the AN SSSR research work on exploitation of gas in connection with the extensive use of gas in various branches of the Ukrainian national economy.

Like the other sections, the power-chemistry section expressed the desire to hold annual conferences to coordinate research in the power-engineering institutes of the Republics and AN SSSR Affiliates so that there might be an exchange of the results of scientific work and conformity of research programs in the following year.

The conference has shown what enormous possibilities for solving great scientific problems of power engineering exist in the power-engineering institutes of Republic Academies of Sciences and AN SSSR Affiliates.

Reports to the plenum and sections, active exchange of opinions, inspection of the Power-Engineering Institute laboratories, scientific reports and printed treatises -- all these permitted the conference participants to gain exhaustive material on the activity of the power-engineering institutes. As a result of the conference it was possible to coordinate the research in power engineering along definite lines and to establish a more expedient distribution of scientific reports by exchange of information, consultation, and personal contact among the scientists.

At the same time, the representatives invited to the conference from the various ministries, research institutes, and industry rendered positive help in developing more extensive cooperation of forces and resources, as well as in introducing the results of scientific work into the national economy.

- E N D -

- 7 -

CONFIDENTIAL